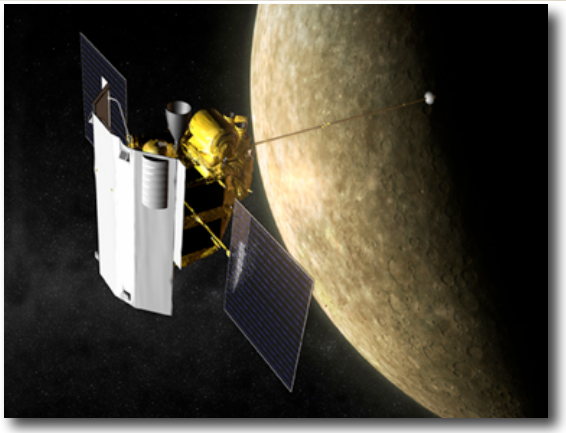
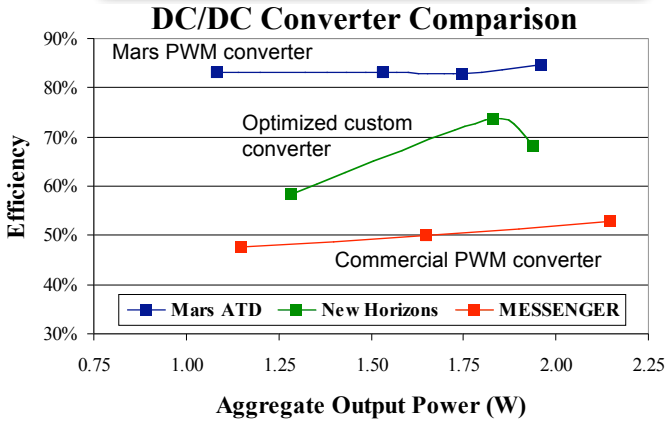
Mars Technology Program Highlight:
Rad-Hard Pulse Width Modulator (PWM) Controller

- Problem 1: Too much power is wasted when DC/DC converters supply power to loads <5W. For example, NASA's MESSENGER spacecraft uses ~30 DC/DC converters, each dissipating 1-3W on low loads <5W. This can total to 30-90W lost across the spacecraft, depending upon the mission phase and what sub-systems and payload systems are active. This means that up to 24% of available power is wasted in converters! The chief culprit is the Pulse Width Modulator (PWM) at the heart of the converter. PWM chips are either efficient or rad-hard, but not both! For example:
  - UC1800 consumes <10mW, tolerates <3krad
  - UC1843 consumes <300mW, tolerates 100krad
- Technology Solution: Develop a new PWM Controller chip that is both efficient at low loads (<5W) and rad-hard (Total Ionizing Dose > 100 krads, Single Event Effects tolerant).
- Problem 2: The aerospace community has limited access to rad-hard electronics developed with NASA funding. It is difficult for Industry to commercialize such parts because the low volume Space market does not support the high Non-Recurrent Engineering (NRE) costs of specialized rad-hard foundries - even after the design is paid for and tested.
- Implementation Solution: Issue an RFP to create a rad-hard PWM and put it in an industrial catalog so it can be used by the aerospace community. Use "*Design Hardening*" so the PWM can be built in a commercial foundry. NASA pays a share of the NRE. APL acts as the Government Trusted Agent by talking to the user and supplier community to understand the requirements and set specifications. APL issues the RFP, manages the contract.
- TRL-6 Demonstration: PWM testing included temperature & total ionizing dose (TID >100krad) at APL, as well as accelerated heavy ion testing at Brookhaven National Labs for various Single Event Effects (SEE) including latchup, upsets, and transients (LET >80 MeV-cm^2/mg). APL designed and built several prototype converters using the PWM controller to demonstrate its operation in the larger context of a DC/DC converter that is 85% efficient.
- Benefit: The Aeroflex RadHard PWM5031 High Speed PWM Controller is now commercially available (http://www.utmc.com/ProductFiles/News/PWM5032Press.pdf) NASA & aerospace community can buy the PWM for use in efficient, rad-hard DC/DC converters on spacecraft and instruments (consumes 10 mW, tolerates >100krad). The PWM is already baselined for the LWS Geospace RBSP spacecraft and payload, and in several proposals to the recent Discovery and Mars Scout AOs.





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